

# In-Situ EBCs for High Performance Composite Propulsion Components, Phase I

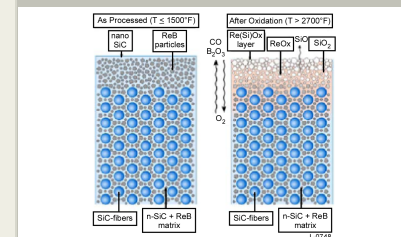
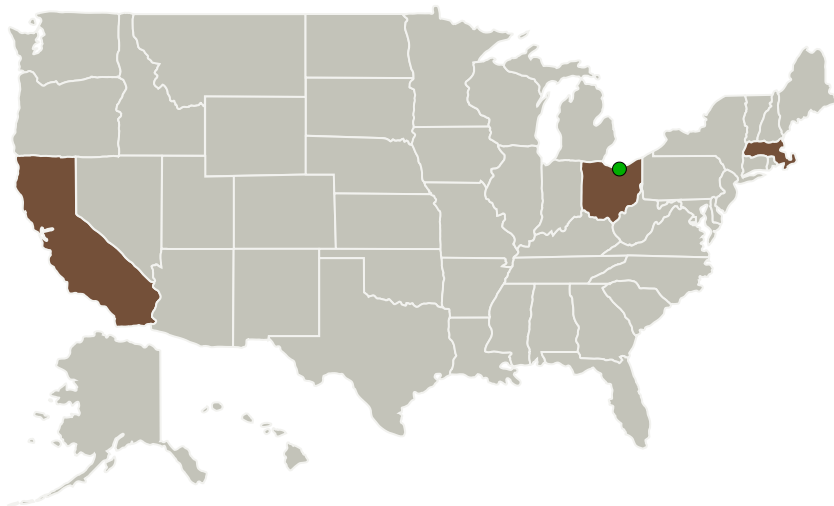
Completed Technology Project (2014 - 2014)



## Project Introduction

Silicon Carbide based ceramic matrix composites (CMCs) offer the potential to fundamentally change the design and manufacture of aeronautical and space propulsion systems to significantly increase performance and fuel efficiency over current metal-based designs. Physical Sciences Inc. (PSI) and our team members at the University of California Santa Barbara (UCSB) will develop, design and fabricate enhanced SiC-based matrices capable of long term operation at 2750 F to 3000 F in the combustion environment. Our approach will build upon PSI's and UCSB's previously successful work in incorporating refractory and rare earth species into the SiC matrix to increase the CMC use temperatures and life-time capabilities by improving the protective oxide passivation layer that forms during use. As part of this work we will create physics based-materials and process models that qualitatively define methods of improving matrix properties and the interaction of the fibers, interphases and matrix with each other. In the Phase I program the PSI team will focus on performing experiments and develop models predicting the effect of phase distribution, grain size, chemical composition, matrix density, and surface flaws on the oxidation behavior of the CMC matrix. During the Phase II program we will iteratively improve the CMC performance by optimizing the composition and characteristics of the additives based on oxidation and mechanical test results.

## Primary U.S. Work Locations and Key Partners



In-situ EBCs for High Performance Composite Propulsion Components Project Image

## Table of Contents

Project Introduction	1
Primary U.S. Work Locations and Key Partners	1
Project Transitions	2
Images	2
Organizational Responsibility	2
Project Management	2
Technology Maturity (TRL)	2
Technology Areas	3
Target Destinations	3

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Organizations Performing Work	Role	Type	Location
Physical Sciences, Inc.	Lead Organization	Industry	Andover, Massachusetts
● Glenn Research Center(GRC)	Supporting Organization	NASA Center	Cleveland, Ohio
University of California-Santa Barbara(UCSB)	Supporting Organization	Academia	Santa Barbara, California

## Primary U.S. Work Locations

California	Massachusetts
Ohio	

## Project Transitions

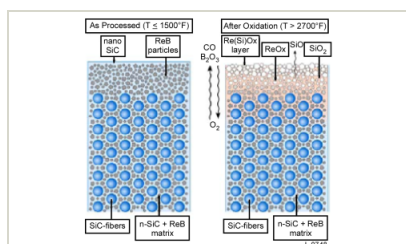
▶ **June 2014:** Project Start

✓ **December 2014:** Closed out

## Closeout Documentation:

- Final Summary Chart(<https://techport.nasa.gov/file/140624>)

## Images



## Project Image

In-situ EBCs for High Performance Composite Propulsion Components  
Project Image

(<https://techport.nasa.gov/image/129916>)

## Organizational Responsibility

## Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

## Lead Organization:

Physical Sciences, Inc.

## Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

## Project Management

## Program Director:

Jason L Kessler

## Program Manager:

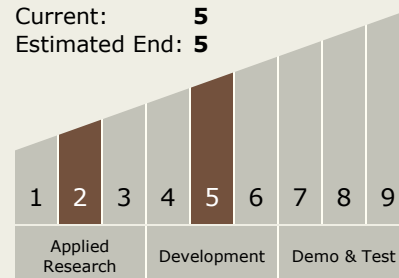
Carlos Torrez

## Principal Investigator:

Frederick S Lauten

## Technology Maturity (TRL)

Start: 2  
Current: 5  
Estimated End: 5



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## Technology Areas

### Primary:

- TX12 Materials, Structures, Mechanical Systems, and Manufacturing
  - └ TX12.1 Materials
    - └ TX12.1.4 Materials for Extreme Environments

## Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System